

Appendix E - City of Seattle Modified Procedure for Conducting a Pilot Infiltration Test

The Pilot Infiltration Test (PIT) consists of a relatively large-scale infiltration test to better measure infiltration rates for design of stormwater infiltration facilities. The PIT reduces some of the scale errors associated with relatively small-scale double ring infiltrometer or “stove-pipe” infiltration tests. It is not a standard test but rather a practical field procedure based on the methods recommended by Ecology’s Technical Advisory Committee. Correction factors must be applied to the infiltration rate measured using PIT to establish a design infiltration rate for BMP sizing.

E.1 Infiltration Test

- Excavate the test pit to the depth of the bottom of the proposed infiltration facility. Lay back the slopes sufficiently to avoid caving and erosion during the test.
- The size of the bottom of the test pit should be as close to the size of the planned infiltration facility as possible, but not less than 2 feet by 2 feet. Where water availability is a problem, smaller areas may be considered as determined by the site professional.
- Accurately document the size and geometry of the test pit.
- Install a device capable of measuring the water level in the pit during the test. This may be a pressure transducer (automatic measurements) or a vertical measuring rod (minimum 5 feet long) marked in half-inch increments in the center of the pit bottom (manual measurements).
- Use a rigid 6-inch-diameter pipe with a splash plate or some other device on the bottom of the pit to reduce side-wall erosion and excessive disturbance of the pit bottom. Excessive erosion and disturbance may result in clogging and yield lower than actual infiltration rates.
- Add water to the pit at a rate that will maintain a water level between 3 and 4 feet above the bottom of the pit.

Note: A water level of 3 to 4 feet provides for easier measurement and flow stabilization control. However, the depth should not exceed the proposed maximum depth of water expected in the completed facility.

Every 15 to 30 minutes, record the cumulative volume and instantaneous flow rate in gallons per minute necessary to maintain the water level at the same point (between 3 and 4 feet) on the measuring rod. This can best be accomplished with an in-flow meter. It can also be accomplished by timing how long it takes to fill a known volume such as a 5 gallon bucket.

Add water to the pit until 1 hour after the flow rate into the pit has stabilized (constant flow rate) while maintaining the same pond water level (usually 17 hours).

After the flow rate has stabilized, turn off the water and record the rate of infiltration in inches per hour using the pressure transducer or measuring rod, until the pit is empty.

E.2 Data Analysis

Calculate and record the infiltration rate in inches per hour until 1 hour after the flow has stabilized.

Note: Use statistical/trend analysis to obtain the hourly flow rate when the flow stabilizes. This would be the lowest hourly flow rate.

E.3 Apply Correction Factor

The infiltration rate obtained from the PIT test shall be considered to be a short-term rate. This “short-term” rate must be reduced through correction factors to account for site variability and number of tests conducted, degree of long-term maintenance and influent pretreatment/control, and potential for long-term clogging due to siltation and bio-buildup. The corrected infiltration rate is considered the “long-term” or “design” infiltration rate and is used for all BMP sizing calculations.

One exception to the requirement for a correction factors applies to bioretention facilities. Specifically, when imported bioretention soil is used, no correction factor is required for the infiltration rate of the underlying native soil.

A minimum infiltration rate correction factor of 2.0 is required for all facilities designed using the PIT method. Correction factors greater than 2.0 should be considered for situations where long-term maintenance will be difficult to implement, where little or no pretreatment is anticipated, or where site conditions are highly variable or uncertain. These situations require the use of best professional judgment by the site engineer and the approval by the City of Seattle. The typical range of correction factors to account for these issues, based on Ecology’s guidance, is summarized in Table E-1. **In no case shall the design infiltration rate exceed 10 inches per hour.**

Table E-1 Correction Factors to be Used With In-Situ Infiltration Measurements to Estimate Long-Term Design Infiltration Rates.

Issue	Partial Correction Factor
Site variability and number of locations tested	CFv = 1.5 to 6
Degree of long-term maintenance to prevent siltation and bio-buildup	CFm = 2 to 6
Degree of influent control to prevent siltation and bio-buildup	CFi = 2 to 6

Total Correction Factor (CF) = CFv + CFm + CFi

The following discussions are to provide assistance in determining the partial correction factors that may apply.

Site variability and number of locations tested – The number of locations tested must be capable of producing a picture of the subsurface conditions that fully represents the conditions throughout the facility site. The partial correction factor used for this issue depends on the level of uncertainty that adverse subsurface conditions may occur. If the range of uncertainty is low—for example, conditions are known to be uniform through previous exploration and site geological factors—one pilot infiltration test may be adequate to justify a partial correction factor at the low end of the range. If the level of uncertainty is high, a partial correction factor near the high end of the range may be appropriate. This might be the case where the site conditions are highly variable due to a deposit of ancient landslide debris, or buried stream channels. In these cases, even with many explorations and several pilot infiltration tests, the level of uncertainty may still be high. A partial correction factor near the high end of the range could be assigned where conditions have a more typical variability, but few explorations and only one pilot infiltration test is conducted. That is, the number of explorations and tests conducted do not match the degree of site variability anticipated.

Degree of long-term maintenance to prevent siltation and bio-buildup – The standard of comparison here is the long-term maintenance requirements provided in Appendix D with these requirements would be justification to use a partial correction factor at the low end of the range. If there is a high degree of uncertainty that long-term maintenance will be carried out consistently, or if the maintenance plan is poorly defined, a partial correction factor near the high end of the range may be justified.

Degree of influent control to prevent siltation and bio-buildup – A partial correction factor near the high end of the range may be justified under the following circumstances:

- If the infiltration facility is located in a shady area where moss buildup or litter fall buildup from the surrounding vegetation is likely and cannot be easily controlled through long-term maintenance
- If there is minimal pre-treatment, and the influent is likely to contain moderately high TSS levels.

If influent into the facility can be well controlled such that the planned long-term maintenance can easily control siltation and biomass buildup, then a partial correction factor near the low end of the range may be justified.

The determination of long-term design infiltration rates from in-situ infiltration test data involves a considerable amount of engineering judgment. Therefore, when reviewing or determining the final long-term design infiltration rate, the local jurisdictional authority should consider the results of both textural analyses and in-situ infiltration tests results when available.

Example:

The area of the bottom of the test pit is 8.5 feet by 11.5 feet.

Water flow rate was measured and recorded at intervals ranging from 15 to 30 minutes throughout the test. Between 400 minutes and 1,000 minutes, the flow rate stabilized between 10 and 12.5 gallons per minute or 600 to 750 gallons per hour, or an average of $(9.8 + 12.3) / 2 = 11.1$ inches per hour.

Applying at least the minimum correction factor of 2.0 (example only) the design long-term infiltration rate becomes 5.6 inches per hour, anticipating adequate maintenance and pre-treatment.